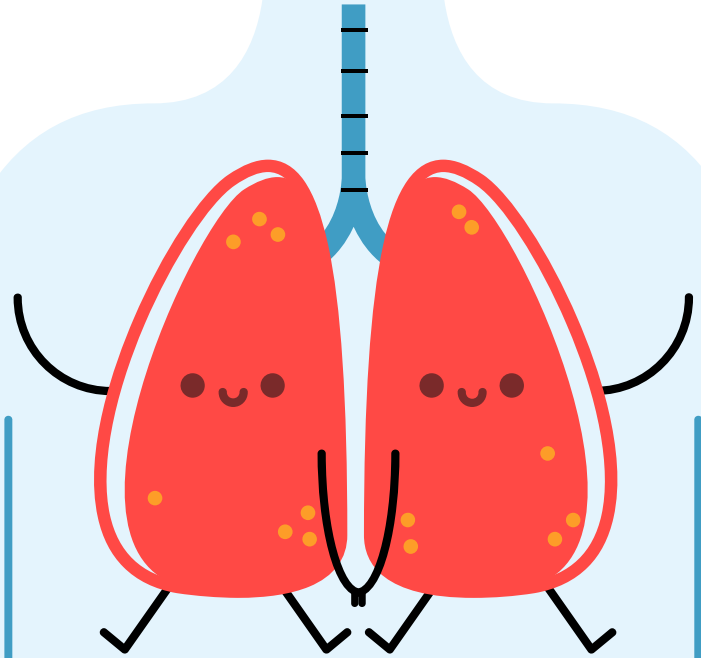


Asthma with Respiratory Distress

Case Report

臺北榮總藥學部 樊心蓉 藥師



Outline

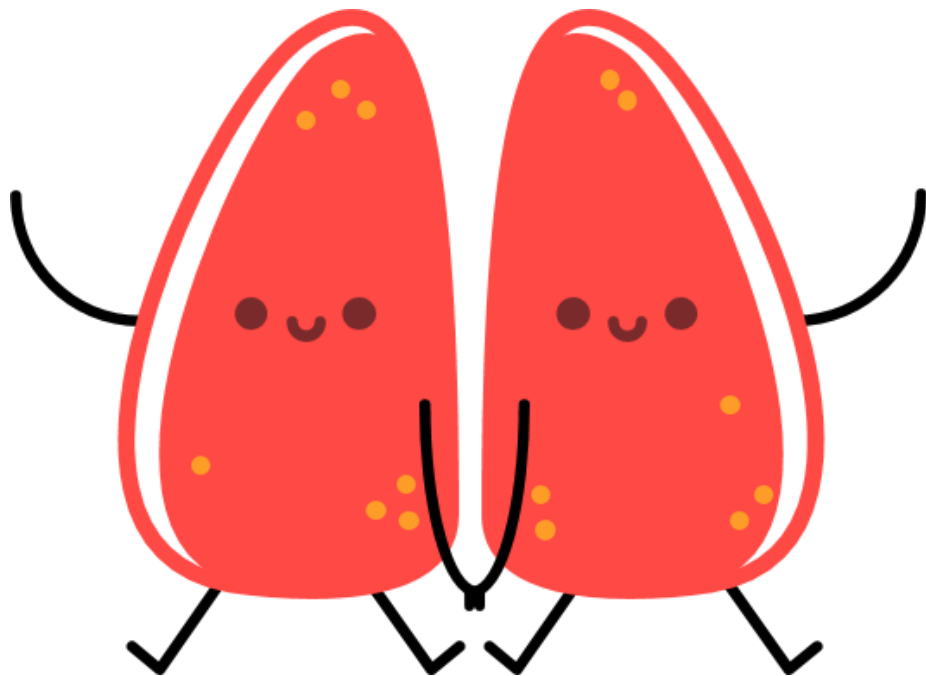
Case Introduction

MgSO₄ for Severe Acute Asthma

SCS Timely Administration in ED
SCS: Systemic Corticosteroid

Conclusion





01

Case Introduction

Medical History

About the patient

Patient 4 years old, 17.5 Kg

Gender Male

Past history

- Asthma with ICS (Fluticasone propionate 50 mcg BID)
- The controller was tapered down in the past 2 years
- Discontinued for a couple of months
- Restarted in recent few days

Present illness

- He suffered from cough with vomiting 4 days before the current admission and received treatment from his primary care physician and felt slightly better in the beginning.
- Respiratory distress recurred with fever and poor activity 1 day before the current admission.

Key findings

At out ER:

- BT 37.8°C, RR 20, O₂ saturation 92%
- **Physical examination:**
 - Abnormal breath sounds with bilateral loud wheezing and severe retraction
- **Chest radiography:**
 - Hyperinflation and a few infiltrates in the right lower lobe.

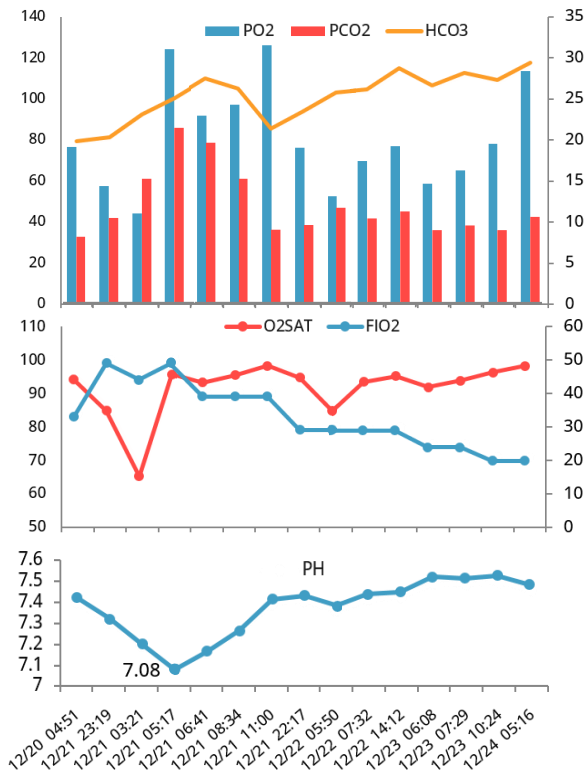
Impression

- Asthma, acute exacerbation
- Severe respiratory distress



Drug Profile and Lab Data

學名	劑量	單位	途徑	頻次	ER	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27
Ipratropium/Salbutamol sol 2.5 ml	1VIAL	IH	Q4H				Q6H						
Epinephrine inj 1mg/1ml	0.2AMP	SC	ONCE			+IM							
Magnesium sulfate inj 10% 20 m	0.45AMP	IVA	ONCE										
Salbutamol inh. soln 5 mg/2.5 ml	0.6AMP	IH	Q6HV										
Procaterol liquid 5 mcg/ml 60 ml	X1BOT	PO	BID										THO
Hydrocortisone sod S inj 100 mg	40MG	IVA	Q6H			35 mg							
Budesonide neb. inh. susp. 1 mg/2 ml	1BG	IH	ONCE										
Prednisolone solu 1 mg/ml 60 ml	X1BOT	PO	BID										
Amoxicillin 1 g/Clavulanic acid 200 mg	1000MG	IVA	Q8H			600 mg							
Acetaminophen syrup 24 mg/ml 60 ml	X1BOT	PO	Q6HPRN										
Ibuprofen susp 20 mg/ml 60 ml	X1BOT	PO	Q6HPRN										
Sodium bicarbonate inj 7% 20ml	1AMP	IVA	ONCE										
Pantoprazole iv inj 40 mg	20MG	IVA	QD										
Famotidine tab 20 mg	0.5TAB	PO	HS										
Pot. gluconate soln 20 mEq/15 ml	1AMP	PO	TIDPC										
Acetylcysteine granules 200 mg/3 g	0.33WP	PO	TID										THO
Platycodon fluidextract 120 ml	X1BOT	PO	TID										THO



Initial Assessment of Acute Asthma

Initial assessment of acute asthma exacerbations in children 5 years and younger from **GINA guideline**

Symptoms	Mild	Severe
Altered consciousness	No	Agitated, confused or drowsy
Oximetry on presentation (SaO ₂)	>95%	<92%
Speech	Sentences	Words
Pulse rate	<100 beats/minute	>180 beats/minute (0-3 years) >150 beats/minute (4-5 years)
Respiratory rate	≤ 40/minute	>40/minute
Central cyanosis	Absent	Likely to be present
Wheez intensity	Variable	Chest may be quiet

The Modified Pulmonary Index Score (MPIS)

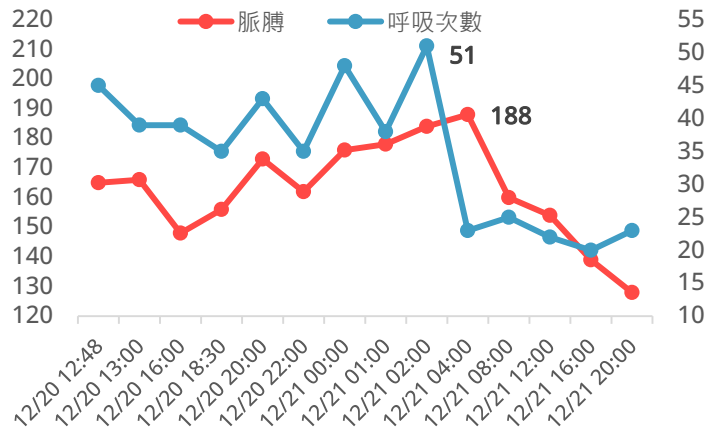
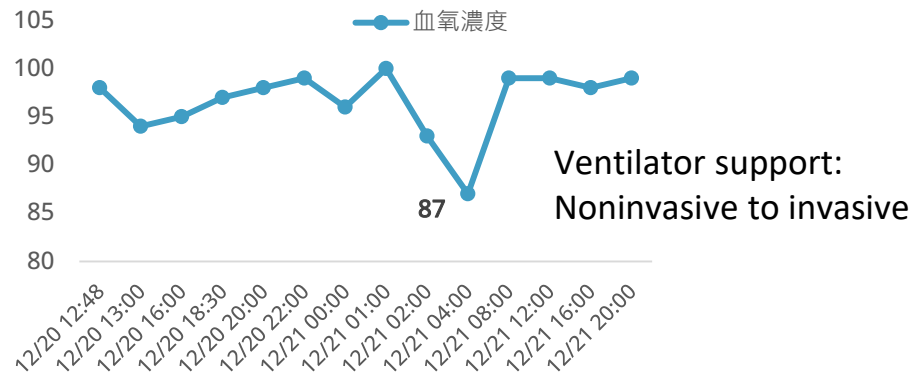
	Score				
	0	1	2	3	
Oxygen saturation, %	>95	93-95	90-92	<90	
Accessory muscle use	None	Mild	Moderate	Severe	
Inspiratory-to-expiratory flow ratio	2:1	1:1	1:2	1:3	
Wheezing	None	End expiratory	Inspiratory and expiratory wheeze, good aeration	Inspiratory and expiratory wheeze, decreased aeration	
Heart rate, (/min)					
	<3 years old	<120	120-140	141-160	>160
	≥3 years old	<100	100-120	121-140	>140
Respiratory rate, (/min)					
	<6 years old	≤30	31-45	46-60	>60
	≥6 years old	≤20	21-35	36-50	>50

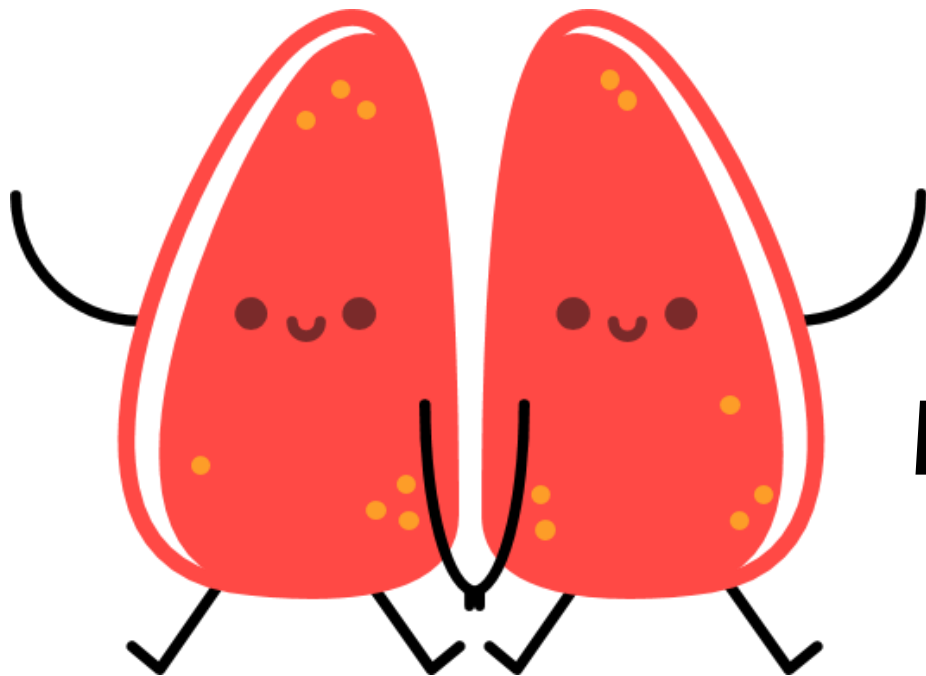
- MPIS <7 - Mild exacerbation
- MPIS 7-10 - Moderate exacerbation
- MPIS ≥10 - Severe exacerbation

Severe Asthma Exacerbation

Symptoms	Mild	Severe
Altered consciousness	No	Agitated, confused or drowsy
Oximetry on presentation (SaO ₂)	>95%	<92% ✓
Speech	Sentences	Words
Pulse rate	<100 beats/minute	>180 beats/minute (0-3 years) ✓ >150 beats/minute (4-5 years) ✓
Respiratory rate	≤ 40/minute	>40/minute ✓
Central cyanosis	Absent	Likely to be present
Wheez intensity	Variable	Chest may be quiet

	Score				
	0	1	2	3	
Oxygen saturation, %	>95	93-95	90-92	<90	✓
Accessory muscle use	None	Mild	Moderate	Severe	✓
Inspiratory-to-expiratory flow ratio	2:1	1:1	1:2	1:3	✓
Wheezing	None	End expiratory	Inspiratory and expiratory wheeze, good aeration	Inspiratory and expiratory wheeze, decreased aeration	✓
Heart rate, (/min)					
<3 years old	<120	120-140	141-160	>160	
≥3 years old	<100	100-120	121-140	>140	✓
Respiratory rate, (/min)					
<6 years old	≤30	31-45	46-60	>60	✓
≥6 years old	≤20	21-35	36-50	>50	





02

Magnesium sulfate (MgSO₄)

for Severe Acute Asthma

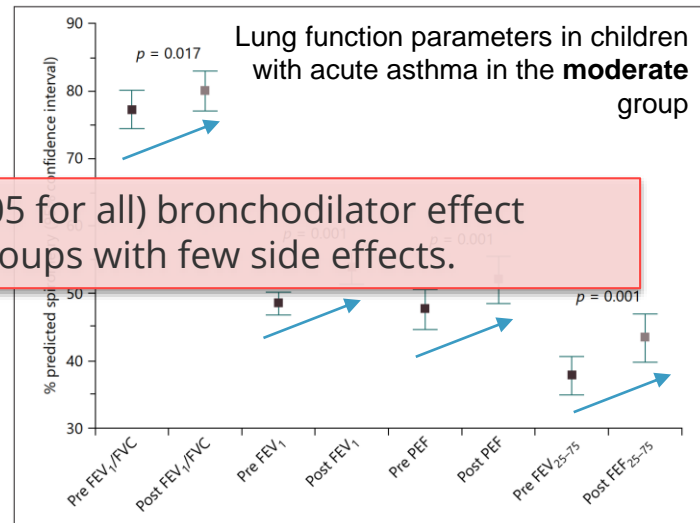
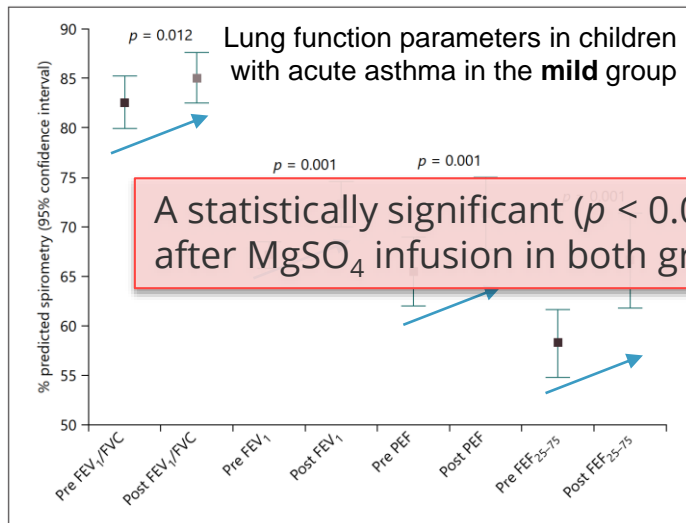
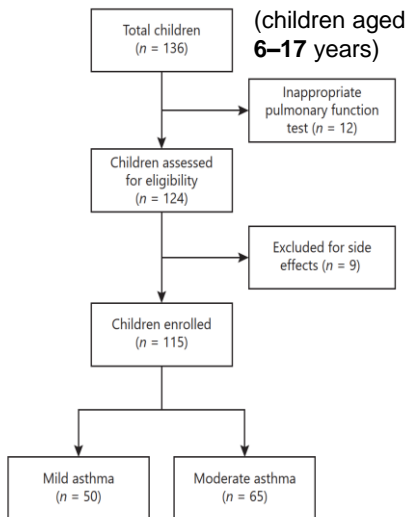
Efficacy of Magnesium Sulfate Treatment in Children with Acute Asthma

Ali Özdemir^a Dilek Doğruel^b

Significance of the Study

- A considerable number of patients.
- It appears to have a beneficial bronchodilator response by providing **sufficient bronchodilator effect** on pulmonary function parameters in children with acute asthma.
- **Systemic magnesium sulfate** may be considered for patients with acute asthma attack.

Enrollment flow diagram



A statistically significant ($p < 0.05$ for all) bronchodilator effect after MgSO₄ infusion in both groups with few side effects.

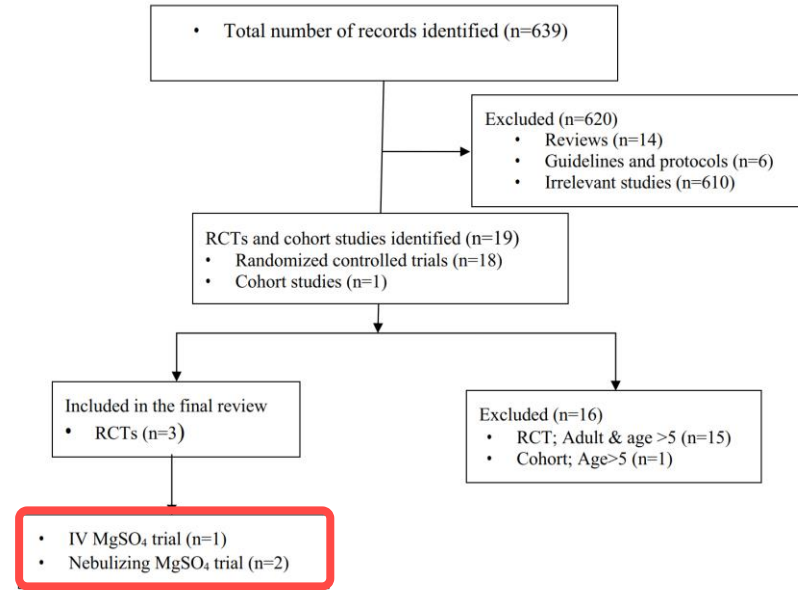
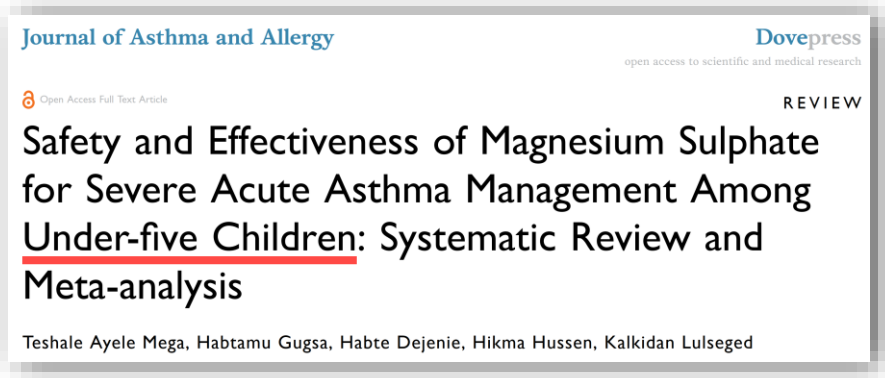
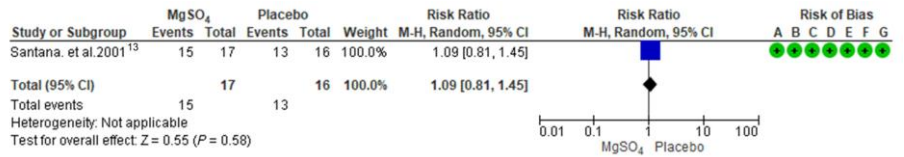


Table I Characteristics of the Included Trials for the Safety and Efficacy Analysis of MgSO₄

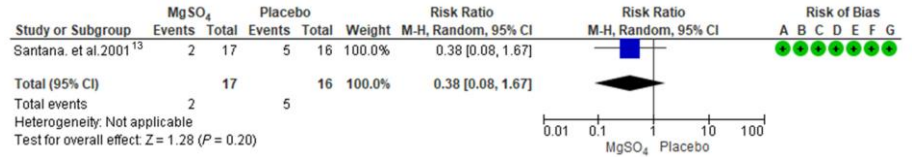
Study	Location	Sample Size	Age (Years)	Asthma Severity	Total MgSO ₄ Dose	Outcome
Schuh et al 2020 ¹	Canada	816	Median 4	Severe acute	Nebulized: 600 mg	Hospitalization
Powell et al 2013 ¹²	United Kingdom	505	Mean 4	Severe acute	Nebulized: 250 mmol/L	Hospitalization
Santana. et al 2001 ¹³	Brazil	50	Mean 4.5	Severe acute	IV: 50 mg/kg IV	Respiratory acidosis

The Effectiveness and Safety of MgSO₄

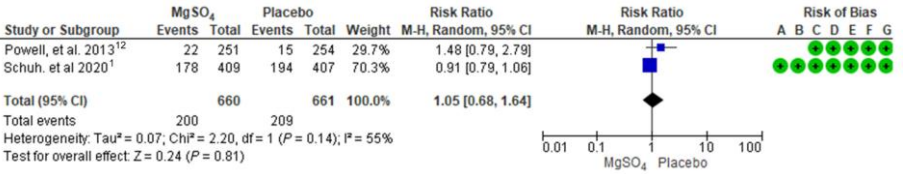
The effectiveness of **IV MgSO₄** for managing acute severe asthma among children under five



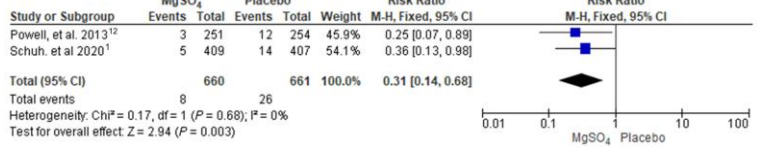
The safety of **IV MgSO₄** for managing acute severe asthma among children under five



The effectiveness of **nebulized MgSO₄** for managing acute severe asthma among children under five



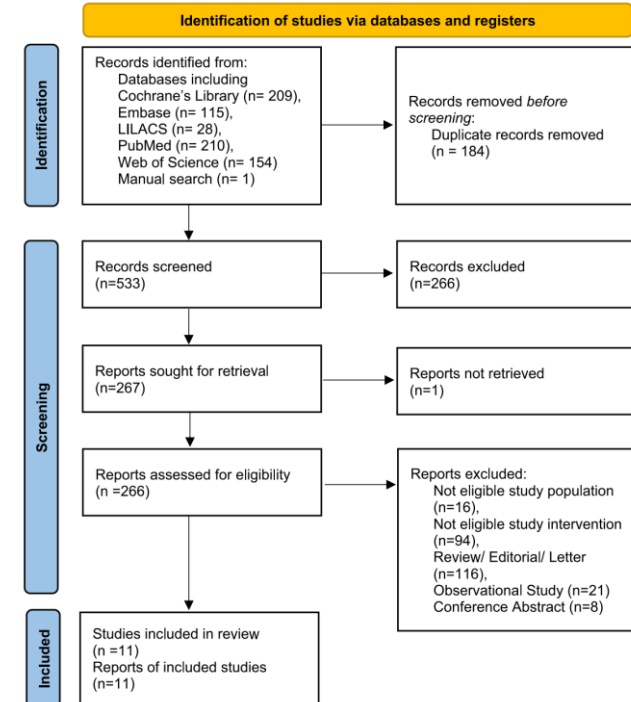
The safety of **nebulized MgSO₄** for managing acute severe asthma among children under five.



- **Intravenous MgSO₄** may not be superior to conventional treatment in **moderate to severe** acute asthma among children and neither have significant adverse effects.
- Similarly, **nebulized MgSO₄** showed no significant effect on respiratory function in moderate to severe acute asthma in children under five but it seems a safer alternative.

Review

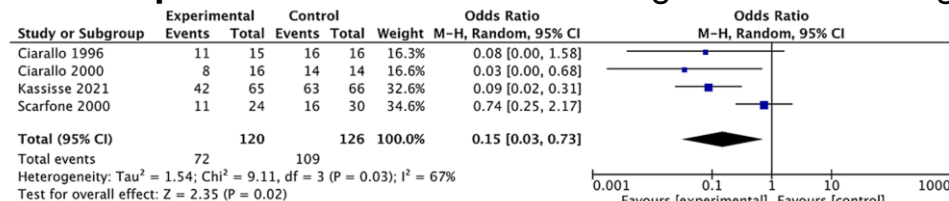
 Intravenous magnesium sulfate for asthma exacerbations in children:
 Systematic review with meta-analysis

 Dominika Ambrożej^{a,b}, Aleksander Adamiec^{a,b}, Erick Forno^c, Izabela Orzolek^a,
 Wojciech Feleszko^a, Jose A. Castro-Rodriguez^{a,7}

Table 1
 Characteristics of the included studies and the summary of their risk of bias assessment.

Authors	Study design	Total NAge range (yrs)	Country	Settings	Experimental	Comparator	Outcome	D1	D2	D3	D4	D5	Overall	
Ciarallo L et al. 1996	Double-blind placebo-controlled randomized clinical trial	31(6-18)	USA	Emergency department	Single dose of MgSO ₄ infusion (25 mg/kg, max 2 g) over 20 min	Single dose placebo infusion over 20 min	Change in pulmonary function between enrollment at 50, 65, 80, 95, 110 min (PEFR, FEV1, FVC)						Low risk	
Devi PR et al. 1997	Double-blind placebo-controlled randomized clinical trial	47(1-12)	India	Emergency department	Single dose of MgSO ₄ infusion (0.2 ml/kg, 50 % solution, max. 2 g) over 35 min	Single dose placebo infusion over 35 min	Change in PEFR and oxygen saturation starting from 30 min to next hours and change in asthma score						Some concerns	
Gürkan F et al. 1999	Double-blind placebo-controlled randomized clinical trial	20(6-16)	Turkey	Emergency department	Single dose of MgSO ₄ infusion (40 mg/kg, max. 2 g) over 20 min	Single dose of an equivalent volume of saline	Change in PEFR and asthma score						High risk	
Ciarallo L et al. 2000	Double-blind placebo-controlled randomized clinical trial	30 (6-17.9)	USA	Emergency department	Single dose of MgSO ₄ infusion (40 mg/kg, max. 2 g) over 20 min	Single dose placebo infusion over 20 min	Change in PEFR from baseline to 110 min							
Scarfone RJ et al. 2000	Double-blind placebo-controlled randomized clinical trial	54(1-18)	USA	Emergency department	Single dose of MgSO ₄ infusion (75 mg/kg, max. 2.5g) over 20 min	Single dose placebo infusion over 20 min	Mean change in Pulmonary Index Score over 120 min	D1					Randomisation process	
Santana JC et al. 2001	Double-blind randomized clinical trial	50(>2 to < 13)	Brazil	Pediatric Intensive Care Unit	Intravenous MgSO ₄ (2.5 mg/kg/min, diluted in saline, 20mins, total dose 50 mg/kg)	salbutamol (1mcg/kg/min, in saline, 20 min) or placebo (saline 1 ml/kg/h)	Days in PICU, need for mechanical ventilation, number of nebulizations						D2	Deviations from the intended interventions
Torres S et al. 2012	Open-label randomized controlled trial	143 (2-15)	Argentina	Emergency department	Single dose of MgSO ₄ infusion (25 mg/kg, max. 2 g) over 20 min, within the first hour	Further nebulized bronchodilators	Need for mechanical ventilation						D3	Missing outcome data
Singhi S et al. 2014	Open-label randomized controlled trial	100 (1-12)	India	Emergency department	Single dose of MgSO ₄ infusion (50 mg/kg) over 20 min	Single terbutaline infusion	Improvement of four or more points in the CAS score 1 h after the intervention						D4	Measurement of the outcome
Irazuza JE et al. 2016	Open-label randomized controlled trial	38(6-18)	Paraguay	Emergency department	Single dose of MgSO ₄ infusion (50 mg/kg) over > 1 h	HDMI	Discharge rate at 24 h						D5	Selection of the reported result
Daengsuwan T et al. 2017	Open-label randomized controlled trial	28(2-15)	Thailand	Hospital	Single dose of MgSO ₄ infusion (50 mg/kg) over 20 min	3 doses of isotonic MgSO ₄ nebulizer (6 % solution, 2.5 ml) each given 20 min apart	The Wood's Clinical Asthma Score							
Kassise E et al. 2021	Observer-blinded randomized controlled, partly cross-over trial	131 (2-12)	Venezuela	Emergency department	Single dose of MgSO ₄ 50 mg/kg, 30 mins	Rapid and then slow infusion of aminophylline at 5 mg/kg	Changes in mPIS, hospitalization rate							

The Efficacy and Safety of IV MgSO₄

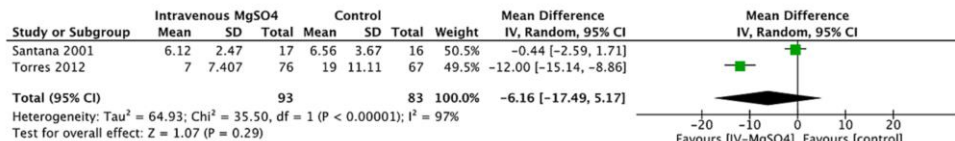
The hospitalization rate after receiving intravenous magnesium sulfate



Less likely to be hospitalized

Compared to placebo (Ciarallo 1996, Ciarallo 2000, Scarfone 2000) or other interventions (aminophylline, Kassisse 2021) studied

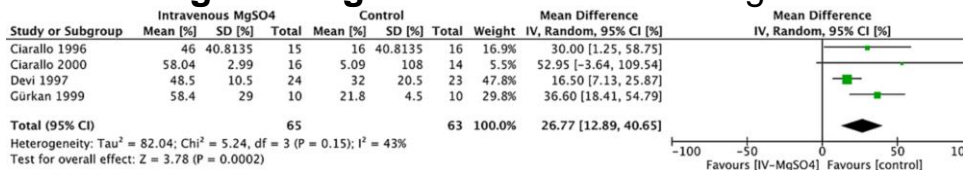
The time to discharge after hospital admission after receiving intravenous magnesium sulfate



No significant difference in the length of stay

Compared to placebo

The change in lung function after receiving intravenous magnesium sulfate



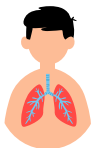
Significant increase in PEFR in the group of patients receiving IV-MgSO₄

Lung function: percentage increase in peak expiratory flow rate

Compared to placebo

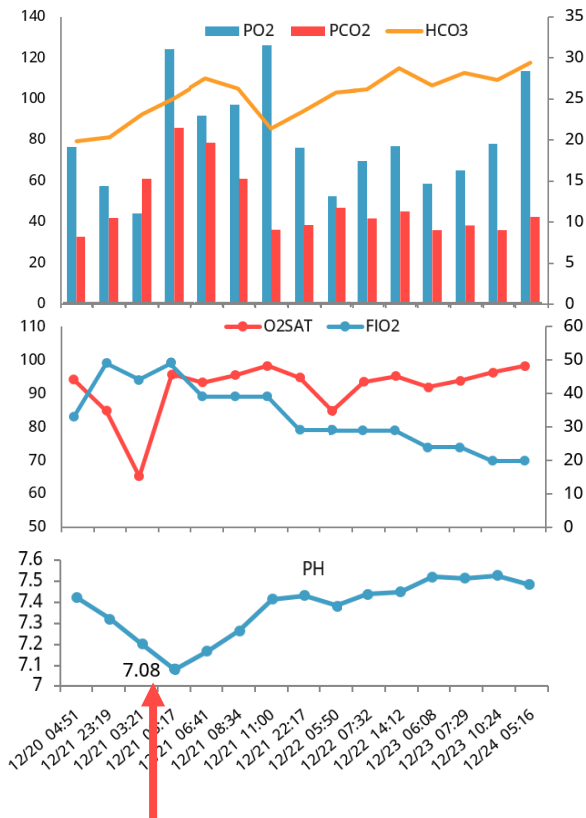
Summary of IV MgSO₄

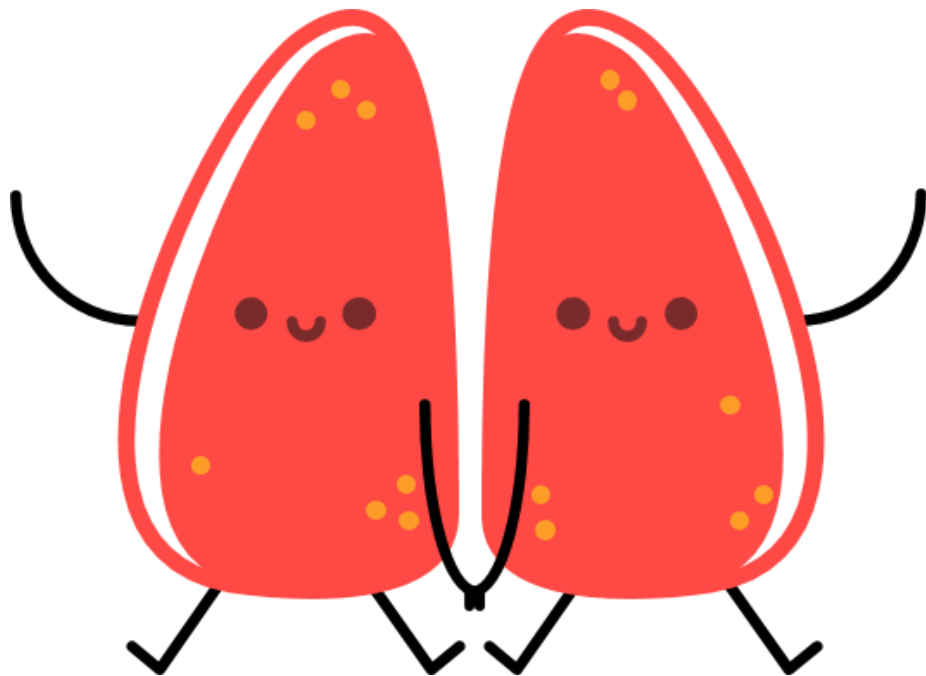
- IV-MgSO₄ administration led to ~ **85 % reduction in the odds of hospitalization** and to **improved peak expiratory flows**, compared to placebo or other second-line IV-treatments such as IV albuterol/salbutamol, terbutaline, or aminophylline.
- The length of the hospital stay was not significantly different in the group of patients receiving IV-MgSO₄.
- About the safety, only one study reported one instance of hypermagnesemia.
- Four out of seven studies reported **significant improvement in symptom scores** with IV-MgSO₄.
- One of two studies showed that children on IV-MgSO₄ needed **significantly less mechanical ventilation**.



Back to the patient...

學名	劑量	單位	途徑	頻次	ER	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27
Ipratropium/Salbutamol sol 2.5 ml	1VIAL	IH	Q4H				Q6H						
Epinephrine inj 1mg/1ml	0.2AMP	SC	ONCE			+IM							
Magnesium sulfate inj 10% 20 m	0.45AMP	IVA	ONCE										
Salbutamol inh. soln 5 mg/2.5 ml	0.6AMP	IH	Q6HV										
Procaterol liquid 5 mcg/ml 60 ml	X1BOT	PO	BID										THO
Hydrocortisone sod S inj 100 mg	40MG	IVA	Q6H			35 mg							
Budesonide neb. inh. susp. 1 mg/2 ml	1BG	IH	ONCE										
Prednisolone solu 1 mg/ml 60 ml	X1BOT	PO	BID										
Amoxicillin 1 g/Clavulanic acid 200 mg	1000MG	IVA	Q8H			600 mg							
Acetaminophen syrup 24 mg/ml 60 ml	X1BOT	PO	Q6HPRN										
Ibuprofen susp 20 mg/ml 60 ml	X1BOT	PO	Q6HPRN										
Sodium bicarbonate inj 7% 20ml	1AMP	IVA	ONCE										
Pantoprazole iv inj 40 mg	20MG	IVA	QD										
Famotidine tab 20 mg	0.5TAB	PO	HS										
Pot. gluconate soln 20 mEq/15 ml	1AMP	PO	TIDPC										
Acetylcysteine granules 200 mg/3 g	0.33WP	PO	TID										THO
Platycodon fluidextract 120 ml	X1BOT	PO	TID										THO





03





Systemic Corticosteroid

Timely Administration in ER

Article

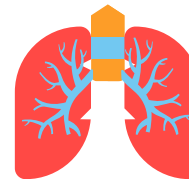
Managing Pediatric Asthma Exacerbations: The Role of Timely Systemic Corticosteroid Administration in Emergency Care Settings—A Multicentric Retrospective Study

Children. 2024;11(2):164

Luna Antonino ^{1,2}, Eva Goossens ^{2,3,4}, Josefiën van Olmen ⁵, An Bael ^{6,7}, Johan Hellinckx ⁸, Isabelle Van Ussel ^{9,10}, An Wouters ⁹, Tijl Jonckheer ¹¹, Tine Martens ¹¹, Sascha Van Nuijs ¹¹, Carolin Van Rossem ^{6,10}, Yentl Driesen ⁶, Nathalie Jouret ¹⁰, Eva Ter Haar ⁶, Sabine Rozenberg ⁶, Els Vanderschaeghe ⁶, Susanne van Steijn ⁶, Stijn Verhulst ^{1,10} and Kim Van Hoorenbeek ^{1,10,*} on behalf of the Antwerp Pediatric Asthma Network Consortium

- **Pediatric asthma** is the most prevalent diagnosed chronic respiratory disease in children.
- It is an **inflammatory disorder** of the airways associated with bronchial hyper-responsiveness, reversible airflow limitation and symptoms like dyspnea, coughing, wheezing and tightness of the chest.
- Difficult to differentiate
- Challenging to determine the ‘true’ prevalence of asthma for children

An exacerbation

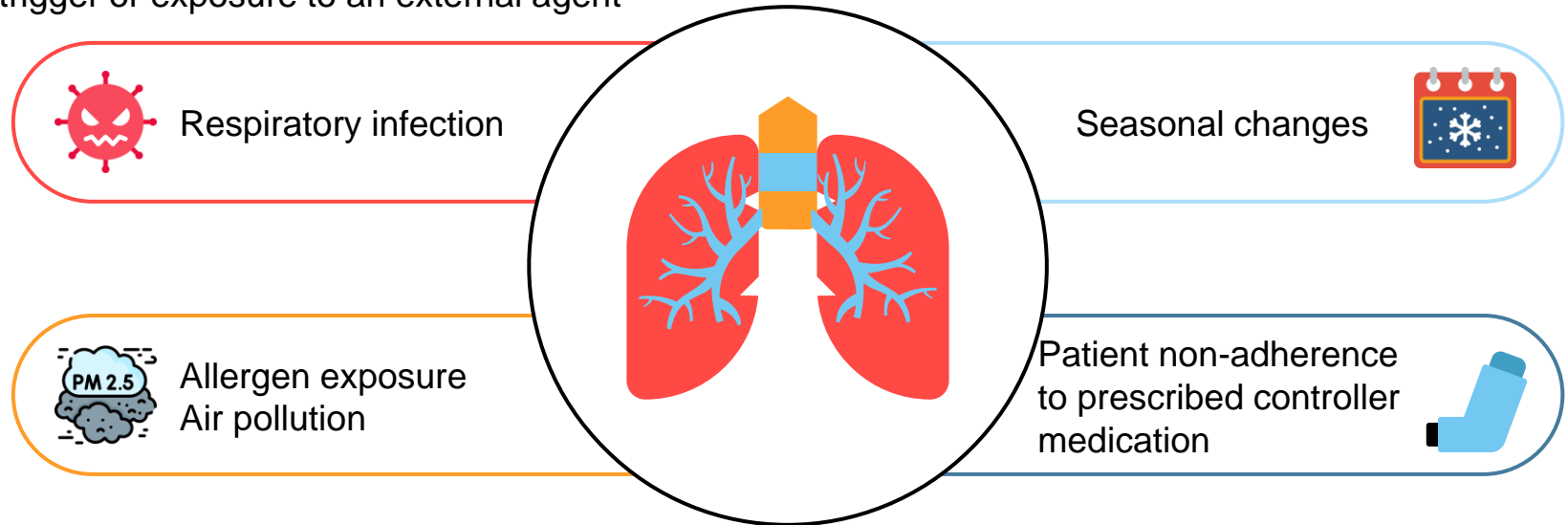


usually occurs as a response to



An exacerbation usually occurs as a response to

A trigger or exposure to an external agent



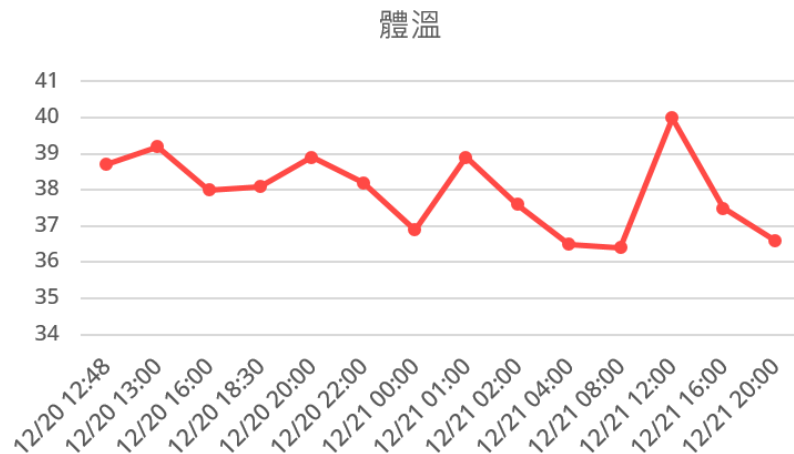


Respiratory infection

Empirical antibiotic treatment

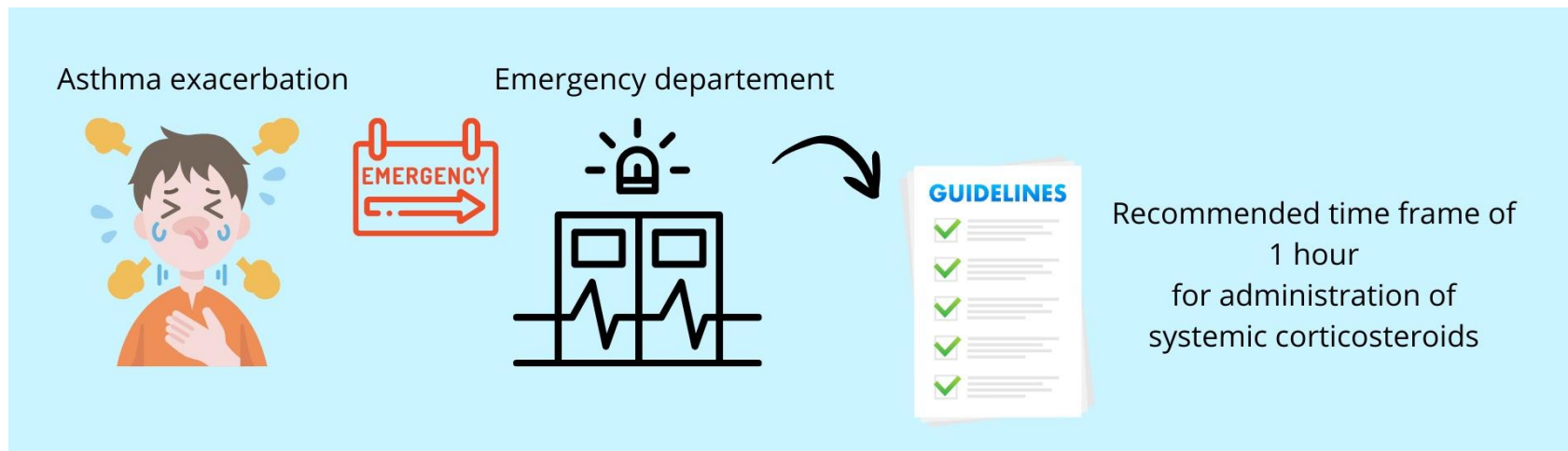
Culture

- 12/20 Blood culture: **No bacterial growth**
- 12/21 Gram stain-Aspirate(endo)
 - EPITHELIAL CELL <10/LF
 - PMN 10-25/LF
 - **No Bacteria Found**
- 12/21 Aspirate(endo): Normal pharyngeal flora



學名	劑量	單位	途徑	頻次	ER	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27
Amoxicillin 1 g/Clavulanic acid 200 mg	1000MG	IVA	Q8H				600 mg						
Acetaminophen syrup 24 mg/ml 60 ml	X1BOT	PO	Q6HPRN										
Ibuprofen susp 20 mg/ml 60 ml	X1BOT	PO	Q6HPRN										

Guideline Recommended Time for SCS



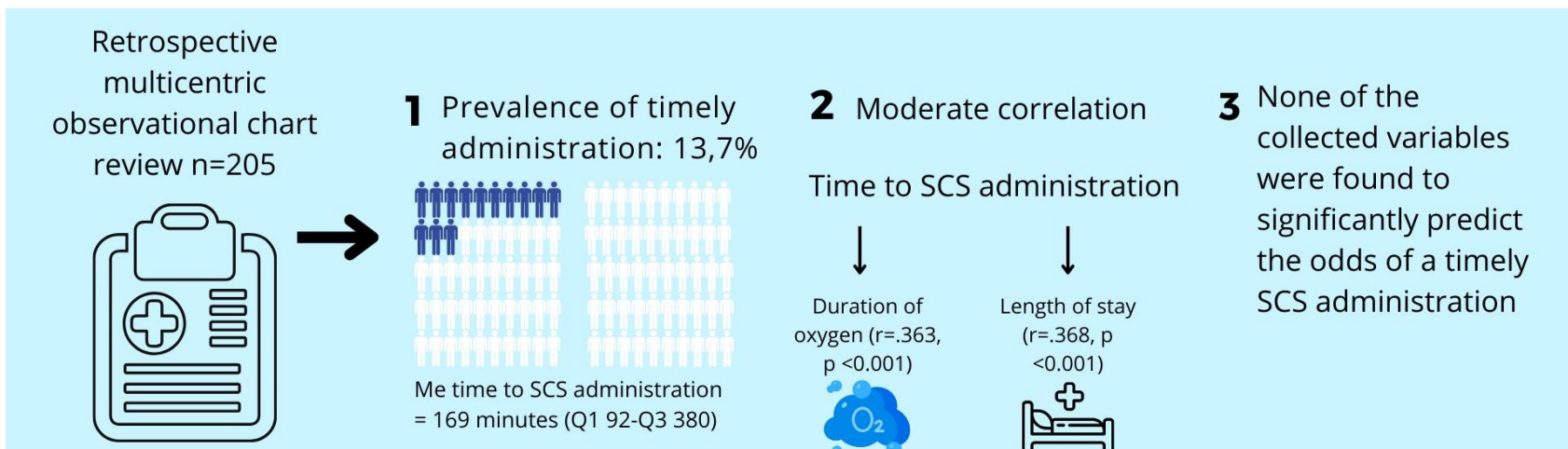
Administering corticosteroids to pediatric patients with asthma presenting at the ED within 1 h



25 min ED length of stay (LOS)



4.8% Admission rates and ED return rates (moderate to severe asthma exacerbation)



<18 yr



Moderate-to-severe asthma exacerbation

Median

Timely: 1 days

Delayed: 3 days

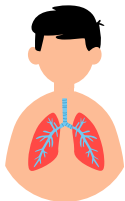
Median LOS:

Timely: 2 days

Delayed: 4 days

Back to the patient...

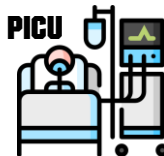
12/20



12/20



12/20



**Respiratory distress,
fever and poor activity**

10:15 Triage

ER medication

Ipratropium/Salbutamol sol 2.5ml 1# IH ONCE 11:02

Sod chloride 2.5 CC IH ONCE 11:02

Hydrocortisone inj 40 mg IVA ONCE 11:15

Epinephrine inj 1mg/1ml 0.2# SC ONCE

學名	劑量	單位	途徑	頻次	ER	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27
Ipratropium/Salbutamol sol 2.5 ml	1 VIAL	IH		Q4H				Q6H					
Epinephrine inj 1mg/1ml	0.2 AMP	SC		ONCE	+IM								
Magnesium sulfate inj 10% 20 ml	0.45 AMP	IVA		ONCE									
Salbutamol inh. soln 5 mg/2.5 ml	0.6 AMP	IH		Q6HV									
Procaterol liquid 5 mcg/ml 60 ml	X1 BOT	PO		BID								THO	
Hydrocortisone sod S inj 100 mg	40 MG	IVA		Q6H		35 mg							
Budesonide neb. inh. susp. 1 mg/2 ml	1 BG	IH		ONCE									
Prednisolone solu 1 mg/ml 60 ml	X1 BOT	PO		BID									
Amoxicillin 1 g/Clavulanic acid 200 mg	1000 MG	IVA		Q8H		600 mg							
Acetaminophen syrup 24 mg/ml 60 ml	X1 BOT	PO		Q6HPRN									
Ibuprofen susp 20 mg/ml 60 ml	X1 BOT	PO		Q6HPRN									



12/24



12/27



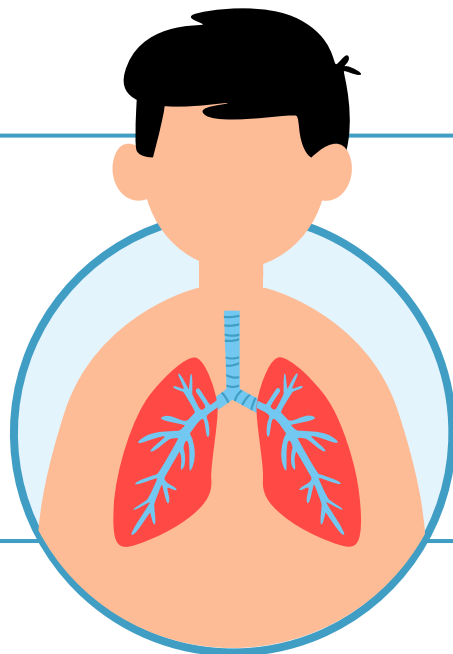
Take Home Message

Adherece

Regular use
controller
medication

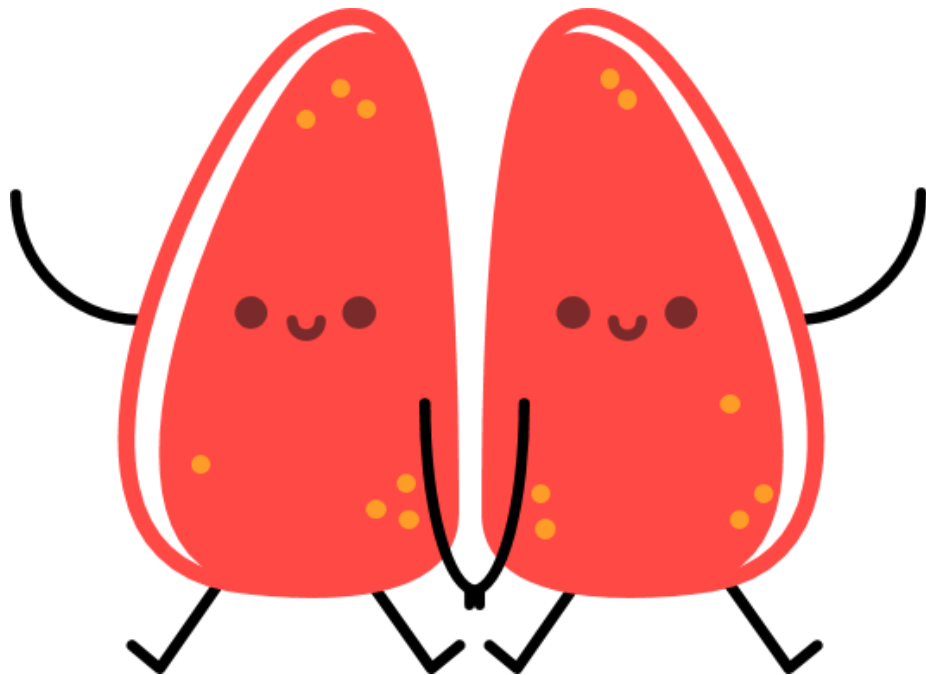
Until now...

Alvesco inhaler
160 mcg/d QD



Patient Education

- Recognition of signs of recurrence and worsening of asthma
- Careful review of inhaler technique
- SABAs should be used on an as-needed basis
- Regular OPD follow up



**Thank you
for attention!!**